

Harnessing Motivational Forces in the Promotion of Physical Activity:

The Community Health Advice by Telephone (Chat) Project*

by

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* *Health Education Research* special issue, “Conceptualizing Health Behavior Change Research”

Abstract

Physical inactivity among middle- and older-aged adults is pervasive and is linked with numerous chronic conditions that diminish health and functioning. Counselor-directed physical activity programs may enhance extrinsic motivation (reflected in social influence theories, such as self-presentation theory), and in turn physical activity adherence, while the counselor is in charge of program delivery. However, external influences can undermine intrinsic motivation, making it more difficult to maintain physical activity once counselor-initiated contact ends. In contrast, programs that diminish the socially evaluative and controlling aspects of the counseling interchange may promote intrinsic motivation (described in cognitive evaluation theory), and, thus, physical activity maintenance, even when counselor-initiated contact ceases. The objective of the Community Health Advice by Telephone (CHAT) Project is to compare these two theories by conducting a randomized controlled trial evaluating the effects of a telephone-administered counseling program delivered by a person (social influence enhancement) or computer (cognitive evaluation enhancement) on physical activity adoption and maintenance over 18 months. Healthy, sedentary adults (N=225) ages 55 years and older are randomized to one of these programs or to a control arm. This study will contribute to advancing motivational theory as well as provide information on the sustained effectiveness of interventions with substantial public health applicability.

Rationale

Despite the recognized role that regular physical activity plays in disease prevention and health promotion across the life span (1), the prevalence of physical inactivity among middle- and older-aged U.S. adults has reached epidemic proportions. For example, less than 22 percent engage regularly in sustained physical activity of any intensity during leisure time, and another 30 percent or more report no leisure-time physical activity at all (1). The projected aging of the U.S. population will no doubt exacerbate the problem if concerted public health efforts are not taken to increase physical activity levels among this growing population segment.

Recent reviews of the physical activity promotion literature note that relatively few studies focus specifically on older populations (2). In addition, few studies have focused on enhancing long-term maintenance of an active lifestyle that is critical for achieving most of its health benefits (2, 3). Available research has generally supported the utility of Social Learning/Social Cognitive theory-derived variables, such as self-efficacy, the use of self-regulatory skills (e.g., goal setting, self-monitoring), and social environmental factors as mediators or predictors of exercise participation in younger and older adults alike (4). Instruction on the ongoing use of such behavioral strategies typically occurs within the context of a personalized counseling relationship using trained staff. Effective physical activity counseling of middle- and older-aged adults has been delivered using face-to-face, telephone-based, and electronic formats (5-7). Such counseling approaches are often used to enhance *extrinsic* motivation (i.e., forces originating outside of the person) for engaging in the target behavior. Chief among such extrinsic forces is the social influence that is brought to bear through the counseling relationship when facilitating behavior change (8-10). Models reflecting the importance of social influence include the elaboration likelihood model (10) and self-presentation perspectives (8).

In contrast to extrinsic motivational processes, *intrinsic* motivational forces that facilitate behavior change involve phenomena that originate within the individual. As exemplified by cognitive evaluation theory and similar perspectives (11), the intrinsic motivational perspective is based on people's needs to be self-determining and competent, and is believed to be crucial to long-term behavior change (11). Few systematic efforts in the physical activity arena have compared approaches aimed at enhancing extrinsic versus intrinsic motivational forces.

Purpose

The major objective of the current randomized controlled trial, called CHAT (Community Health Advice by Telephone) is to evaluate adoption and longer-term maintenance (through 18 months) of physical activity in response to two different telephone-based counseling programs—one delivered by a person (i.e., extrinsic motivation enhancement) and one delivered by a computerized telecommunications system (i.e., intrinsic motivation enhancement). Additional objectives of the trial are to assess the impact of the two interventions on physical functioning and health-related quality of life, evaluate potential mediators and moderators of the intervention-physical activity relationship, and collect information concerning the relative costs of the two programs. A goal of the project is to evaluate the potential cost-savings that may occur with the computer-based intervention.

Theoretical Approaches

As noted earlier, the theoretical perspectives being evaluated emphasize the contributions of differing motivational forces (i.e., social influence versus self-determination) to the behavior change process. The social interactions provided by a human counselor may provide useful forms of modeling and social support that can enhance the initial adoption of health behaviors such as physical activity (4). However, the ongoing inherently evaluative nature of the

interpersonal counseling exchange, as well as the presence of external attributions that link behavior change success to the counselor rather than to the individual's own internal resources, may undermine the intrinsic motivational processes that may be key to sustained behavior change (12). An example from the smoking cessation literature sheds some light on this issue. Smokers randomized to an intrinsic motivation intervention alone (i.e., written personalized feedback aimed at enhancing self-confidence and self-control) had significantly higher rates of continuous abstinence at both 3 and 12 months relative to intervention conditions involving extrinsic forms of motivation (e.g., prizes) (13).

The literature comparing automated- versus human-based information and feedback on cognitive or job performance outcomes also has yielded some intriguing results. Several studies have reported that individuals are more likely to seek feedback about performance from a computer source than from a human (14, 15). In one of these studies, performance feedback had a somewhat negative effect on accomplishment of a mental task only when the source of feedback was a person (as opposed to a computer) (14). In addition, person-mediated feedback, in comparison to either no feedback or computer-mediated feedback, has been shown to be especially debilitating for persons low in self-esteem or high in public self-consciousness (i.e., the tendency to be sensitive to how one is viewed by others) (14, 16).

These studies suggest that computer-based advice and feedback may be perceived as less socially threatening compared to feedback delivered by a person. However, one outcome of computer-based interventions that diminish human exchange may be to promote a level of social isolation that prevents the individual from receiving the affirmation, empathy, personal sharing, and modeling that have been shown to be helpful in facilitating initial behavior change (17).

While each of these two motivational perspectives has been noted to be important to the behavior change process, systematic attempts to evaluate their relative contributions to the successful promotion of noncompetitive forms of physical activity have been rare (18). Of note, however, is the observation, replicated in numerous exercise studies, that when counselor-initiated instruction and social support for physical activity are removed, physical activity levels tend to drop precipitously (19). This drop in physical activity has been found even when the presence of other sources of support and feedback (e.g., other exercise group members) remained (20). These results suggest that counselor-controlled physical activity programs may result in adequate adherence while the counselor is actively in charge of program delivery, but, due to their extrinsic motivational orientation, may result in poor subsequent adherence when the counselor is no longer actively initiating program delivery.

In summary, explicit manipulation of intrinsic versus extrinsic motivational processes in health promotion areas such as smoking cessation suggests that interventions focused on enhancing intrinsic motivation can promote sustained behavior change (13, 21, 22). Yet, such motivational processes have been minimally studied in the physical activity arena. In addition, the manipulation of counselor characteristics (e.g., the use of a human versus a computer) as one means of evaluating the impact of these processes on physical activity levels remains unexplored.

It is important to note that the intrinsic/extrinsic motivational forces under study reside on a continuum and are not mutually exclusive. Thus, both human and computer-controlled counseling can to a certain degree stimulate intrinsic motivational forces (e.g., encouraging the participant to set personal goals and take charge of the behavior change process), as well as extrinsic motivational forces (e.g., providing evaluative feedback). The goal of the present study

is to compare how individuals fare in the counseling endeavor when socially evaluative forces are either more (human) or less (computer) apparent.

Study Methods

The CHAT study is an 18-month investigation of the impact of two different telephone-based counseling interventions on the initiation and maintenance of physical activity behavior. The design includes a 12-month randomized, controlled study in which a community sample of 225 sedentary men and women ages 55 years and older are randomly assigned to one of three experimental arms: 1) a moderate-intensity aerobic exercise regimen delivered via a trained telephone counselor (i.e., Human Counselor arm); 2) a moderate-intensity aerobic exercise and conditioning regimen delivered via an automated, computer-controlled interactive telephone system (i.e., Automated Counselor arm); or 3) a health education attention-control arm. Study participants assigned to the two exercise arms will be followed during an additional maintenance phase occurring from months 13 to 18. Persons participating in the study are free of any medical condition that would limit participation in moderate-intensity exercise, such as sustained brisk walking.

The following hypotheses will be tested: 1) persons randomized to either a Human or Automated Counselor will exhibit significantly higher levels of physical activity across the initial 12 months relative to persons assigned to an attention-control arm; 2) persons randomized to the Human Counselor arm will exhibit significantly higher physical activity levels during this period of counselor-initiated contact than those randomized to the Automated Counselor arm; and 3) while participants in both exercise arms will show maintenance of physical activity levels above their initial baseline levels, those assigned to the Automated Counselor arm will exhibit better

maintenance of physical activity improvements during months 13-18, when counselor-initiated contact is withdrawn, relative to persons assigned to the Human Counselor arm.

Variables of interest. All participants undergo study assessments at baseline, 6, and 12 months, with those randomized to the two physical activity conditions undergoing an additional assessment at 18 months. The primary variable of interest is physical activity behavior, assessed using several assessment tools, including the Stanford 7-Day Physical Activity Recall (23) and the CHAMPS physical activity questionnaire for older adults (24). Heart rate and activity monitors and treadmill exercise performance measures provide additional objective information related to physical activity levels. Secondary variables of interest include measures of physical fitness, self-rated functioning, psychological well-being, and quality of life outcomes.

Assessment of the costs of administering the interventions and a preliminary analysis of the relationship between costs and study outcomes (i.e., cost-effectiveness) are also planned.

Intervention Approach

Overview. To evaluate the effectiveness of interventions based on different motivational perspectives, described earlier, intervention approaches that utilize either human or automated counseling interactions are being applied in CHAT. As noted earlier, systematic comparisons of the effects of computer- versus human-based information and feedback on cognitive or job performance outcomes have indicated that individuals are more likely to actively seek out feedback from a computer source than from a human (14, 15). This finding suggests that the more neutral environment created by the computer may be less socially threatening than that created by a human source of feedback (14, 25). Of relevance to this issue, we have found the overall prevalence of participant-initiated contacts with human counselors to be minimal across physical activity programs lasting up to two years, despite repeated efforts to encourage

participants to contact staff for advice and support (6, 20, 26). Participants' willingness to initiate contact with the counseling source following the end of the more intensive adoption phase of an exercise program may result in longer-term physical activity maintenance, as well as promote enhanced feelings of behavioral competence or mastery (i.e., increased intrinsic motivation).

Despite public perceptions, there has been a growing acceptance and use of computer-related technology among U.S. adults over the age of 55 (27), who currently constitute a surprisingly large segment of the population using computers (approximately 30 percent) (28). A particularly convenient channel for accessing computer-based advice and information is through the telephone. From a communication perspective, telephone contact has been noted to be the 'richest' form of media, following face-to-face contact, with respect to providing immediate feedback, multiple cues, natural language, a personal focus, reduced reliance on reading-related skills, and reduction in message ambiguity (27, 29). Telephone-based communication is also well-accepted in health care, accounting for up to one quarter of patient-health provider encounters (30), and has the potential for being a lower-cost and more convenient alternative to face-to-face contact (31-35). It has been estimated that approximately 95 percent of American households have a telephone, and those without a household phone typically have regular access to one (36, 37).

In the physical activity arena, telephone-based counseling has been an effective strategy for promoting physical activity participation in more than 9 studies targeting middle- and older-aged adults (2). It has also been found to be as effective as face-to-face contact in facilitating physical activity adherence in cardiac patients (38), and significantly more effective than instructor-led group-based formats in promoting sustained physical activity participation among community-based samples of older adults (6, 39). Telephone-based physical activity counseling also has

been found to be an acceptable method in less-educated and minority samples of older (40, 41) and younger adults (42).

The recent successful applications of telephone-linked computer systems with respect to the delivery of advice and information in a variety of health areas (27, 43-45), including physical activity (46, 47), presents both conceptual as well as practical opportunities for health behavior change. The advent of computer systems in the physical activity area that share similar behavioral concepts, strategies, and goals with human counselor-based telephone programs provides an opportunity to evaluate the relative contributions of the extrinsic versus intrinsic motivational perspectives described earlier. They allow for an investigation of counselor source effects (human versus computer) while holding intervention delivery channel (i.e., the telephone) and program content and strategies constant (i.e., similar counseling programs can be delivered by these two different types of ‘counselors’). In addition, they provide the chance for further evaluation of two physical activity interventions with potentially broad public health significance and applicability. This is because they can be delivered in a convenient and low-cost manner over the telephone rather than requiring face-to-face contact.

Intervention Components. For both physical activity arms, a face-to-face individual instructional session, lasting approximately 30-45 minutes, occurs with a study health educator after randomization. During this session, an individualized physical activity plan is developed that emphasizes gradual progression of activity frequency, duration, and intensity towards a goal of 30 minutes or more of moderate-intensity aerobic exercise on most days of the week (1). This approach allows for the individual tailoring of the physical activity program to the preferences and needs of all participants. Individuals randomized to the Automated Counselor arm are also trained to use the telephone-linked computer (TLC) system by placing a call to TLC on speaker

phone with the health educator present. TLC speaks to patients over the telephone using computer-controlled speech generation. The users communicate using the touch-tone keypad of their telephones (44, 46, 47). TLC asks questions and monitors the patient's behavior through self-report, and then provides education and behavioral counseling for the target behavior. After each conversation, TLC stores the information the user has communicated in a database.

For both physical activity conditions, brief (i.e., 10 to 15 minutes) structured 'counselor'-initiated telephone contacts occur initially on a weekly (2 calls), then biweekly (3 calls), then monthly (10 calls) basis, for a total of approximately 15 counselor-initiated contacts during the first year. The contacts are used to provide individualized information, support, and problem-solving around exercise barriers, based on the participant's ongoing reports of physical activity levels, goals, and problem areas. Discussion of cognitive and behavioral strategies, derived from Social Cognitive theory (48) and the Transtheoretical Model (49), occurs as appropriate to each person's stage of motivational readiness to change (50). Participants in both physical activity programs also are encouraged from the beginning to initiate additional telephone contacts with their CHAT Counselor as desired during the first year.

The telephone contacts are supplemented with informational mailings and use of a Yamax Digi-walker pedometer (51). All exercise participants record their physical activity levels (e.g., type, frequency, duration, steps accumulated on the pedometer) on a monthly magnetic refrigerator calendar, and then transmit this information to their 'counselor' via telephone as part of the regular counselor-initiated telephone contacts. Extensive evaluation and pre-testing of the computerized telecommunication system occurred during the first year of the project to ensure that the advice, information, and feedback being delivered by the two counseling programs was as similar as possible.

The purpose of the 6-month Maintenance period, occurring in months 13-18, is to evaluate how well participation can be sustained in each physical activity arm when counselor-initiated telephone contact is removed. At the end of 12 months, participants are encouraged to initiate regular (i.e., monthly, or more frequently if desired) telephone contacts with their respective ‘counselors’ (either person or computer-based). Such a maintenance system represents a lower-cost alternative to counselor-initiated contacts, and thus is potentially more feasible and generalizable on a long-term basis. It also has the potential for enhancing personal feelings of control and mastery over the physical activity program, which may aid long-term maintenance (52).

Intervention quality assurance procedures include audiotaped evaluation of health educator telephone counseling sessions throughout the study; weekly evaluation of the performance of the automated system with respect to successfully completed participant contacts and monitoring of the automated system’s telephone ‘help’ line; and summarization of number, length, and content of the counseling contacts delivered in both physical activity conditions.

Control Arm

The health education attention-control arm is used to control for time, assessment effects, staff attention, and seasonal factors that may potentially influence the outcomes of interest independent of the physical activity regimens themselves. Individuals randomized to this arm are offered a 12-month weekly general health education class, led by a registered dietitian, which includes information on nutrition and other non-exercise topics (e.g., home safety). Following their 12-month participation, individuals in this arm are offered instruction in a home-based physical activity program.

Proposed Mediators of Physical Activity Change

The research model for the study, including some of the mediators of intervention effects being proposed, is shown in **Figure 1**. Among the types of variables that may change as a function of the physical activity interventions and may in turn mediate the relationship between the interventions and the major outcomes of interest are changes in extrinsic versus intrinsic attributions for success or failure (18, 53-55), self-efficacy for physical activity (56, 57), social support for exercise (58), exercise mastery (59, 60), and cognitive and behavioral strategies for exercise behavior change (61), including decisional balance (i.e., weighing the pros and cons to exercise participation) (62). Among the baseline moderators being explored that may predispose individuals to do better or worse in one of the exercise interventions versus the other are gender, initial levels of self-esteem (14, 16, 63, 64), stress (65), public self-consciousness (14, 66, 67), outcome expectations for exercise (68), and social anxiety (66, 69).

Exploration of Relative Costs of the Two Physical Activity Programs

This study will include both assessment of the costs of administering the interventions and a preliminary analysis of the relationship between costs and study outcomes (i.e., cost-effectiveness). Costs associated with implementation include the costs of training staff, staff compensation, the costs of obtaining, setting up, and operating the necessary computer equipment, telephone charges, and other administrative overhead. We will measure the time staff spend in training and carrying out the interventions as well as the actual expenditures associated with staff compensation in the study. The costs associated with the telephone-linked computer system will be monitored during the study. Telephone time will be tracked by the computer system and by the health educators; actual telephone charges during the study period will also be monitored. The costs of compliance by patients include time spent in the counselor-

initiated telephone contacts, in participant-initiated telephone contacts, in individual instruction sessions, and in other contact with the staff. The TLC system and the health educators will track the length of the telephone calls and number of call attempts, and the length of individual instruction sessions will be monitored as the project progresses. These data will be combined to measure the total time cost to participants in the different study conditions. The time participants spend exercising is an outcome variable and will not be counted among the costs of administering the interventions.

The costs of administering the interventions will also be compared to the outcomes data obtained in the study (e.g., weekly minutes spent in appropriate exercise; measures of physical performance) (70). We do not plan a full-scale cost-effectiveness or cost-benefit analysis because of the difficulties associated with identifying long-term changes in health outcomes and health care costs that result from the interventions. Rather, we will simply relate the outcomes observed during the study period to the costs. This will allow us to determine if the intervention that produces the best outcome is the least expensive to administer or, if not, to obtain crude estimates of the value of the additional money spent (e.g., average number of dollars spent to obtain each additional minute of exercise per week). We view these analyses as preliminary, and will use them to evaluate the need for further, more detailed, studies of the cost-effectiveness of these kinds of interventions.

Conclusions

Regular physical activity is critical to health and functioning as people age, yet middle- and older-aged adults remain among the most inactive segments of the U.S. population. In recent years, safe, effective, and practical telephone-based interventions for promoting increases in physical activity, based on Social Cognitive Theory and the Transtheoretical Model, have been

developed and tested in older populations; however, little systematic attention has been paid to counselor characteristics as a means of enhancing (or diminishing) physical activity participation, both during the active phase of the counselor intervention and thereafter. The advent of the promising *interactive telephone-linked computer technology* being applied in the current study provides an avenue for systematically exploring the relative effects of extrinsic versus intrinsic motivational enhancement within the context of exercise counseling. It is notable that, to date, systematic comparisons of an automated counseling system versus a credible human source have been virtually nonexistent in this and other health behavior fields.

The major hypotheses being tested in the CHAT study focus on the relative effectiveness of the human versus automated counselor interventions. Arguably the most important information, however, will be derived from the exploration of which subgroups of individuals do best with which type of counseling program. In light of the heterogeneity of the American population in general and the older aged segment of that population in particular, understanding how best to tailor programs to the needs and preferences of different population subgroups remains a critical public health challenge. It is hoped that the knowledge gained from this study will contribute both theoretically and practically towards meeting this challenge.

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Figure Caption

Figure 1. Research model for the CHAT study, including examples of the mediators of intervention effects being proposed.

RESEARCH MODEL

Independent Variable

Human Counselor
Computer Counselor
Control

Moderators (examples)

Demographics
Baseline levels of:
self-esteem
public self-consciousness
motivational attributions

Mediators (examples)

Changes in:
self-efficacy
social support for exercise
intrinsic/extrinsic attributions
other motivational change processes
(based on Transtheoretical model)

Major Outcomes

Physical Activity
Fitness
Health-related quality of life
Psychological well-being

